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Selected issues related to illegal cannabis cultivation

Summary

For a long time, cannabis-based products have been enjoying unwavering popularity. Not surprisingly, the number of illegal cannabis plantations discovered in Poland and worldwide is increasing year on year. The plantation sizes vary from single plants grown "for own needs" in pots or outside housing, or farm facilities to professional, fully automated cultivations maintained by criminal groups. The article provides a summary of data analysis concerning illicit cannabis plantations liquidated in Poland since 2012. Additionally, the impacts of the most recent amendment to the Act on Counteracting Drug Addiction on the opinions issued by court-appointed experts, in particular, related to the cases involving illicit cannabis plantations, are indicated.

Keywords cannabis plantations, plantation yield estimation, commercial portions of drugs

Introduction

According to plant taxonomy, true hemp (*cannabis sativa L.*)[1] belongs to the genus: *Cannabis*, family: *Cannabaceae*, order: *Rosales*, phylum: *Magnoliophyta*, kingdom: *Plantae*. True hemp is an annual, dioecious plant, which can grow up to 5 meters in height during the growing season lasting 4-8 months under natural conditions[2] Male plants, which produce pollen, are smaller, weaker and less resilient than female plants. They usually die shortly after releasing their pollen. In Poland, hemp is grown for the needs of several industries, such as textile, chemical, pulp and paper, food, cosmetics, pharmaceutical, building materials and seed industry. Hemp fibres can be used for manufacturing cordage, fishing nets, sacks and insulation materials. The seeds, in turn, are used to produce a drying oil, which can be processed into paints and varnishes[3].
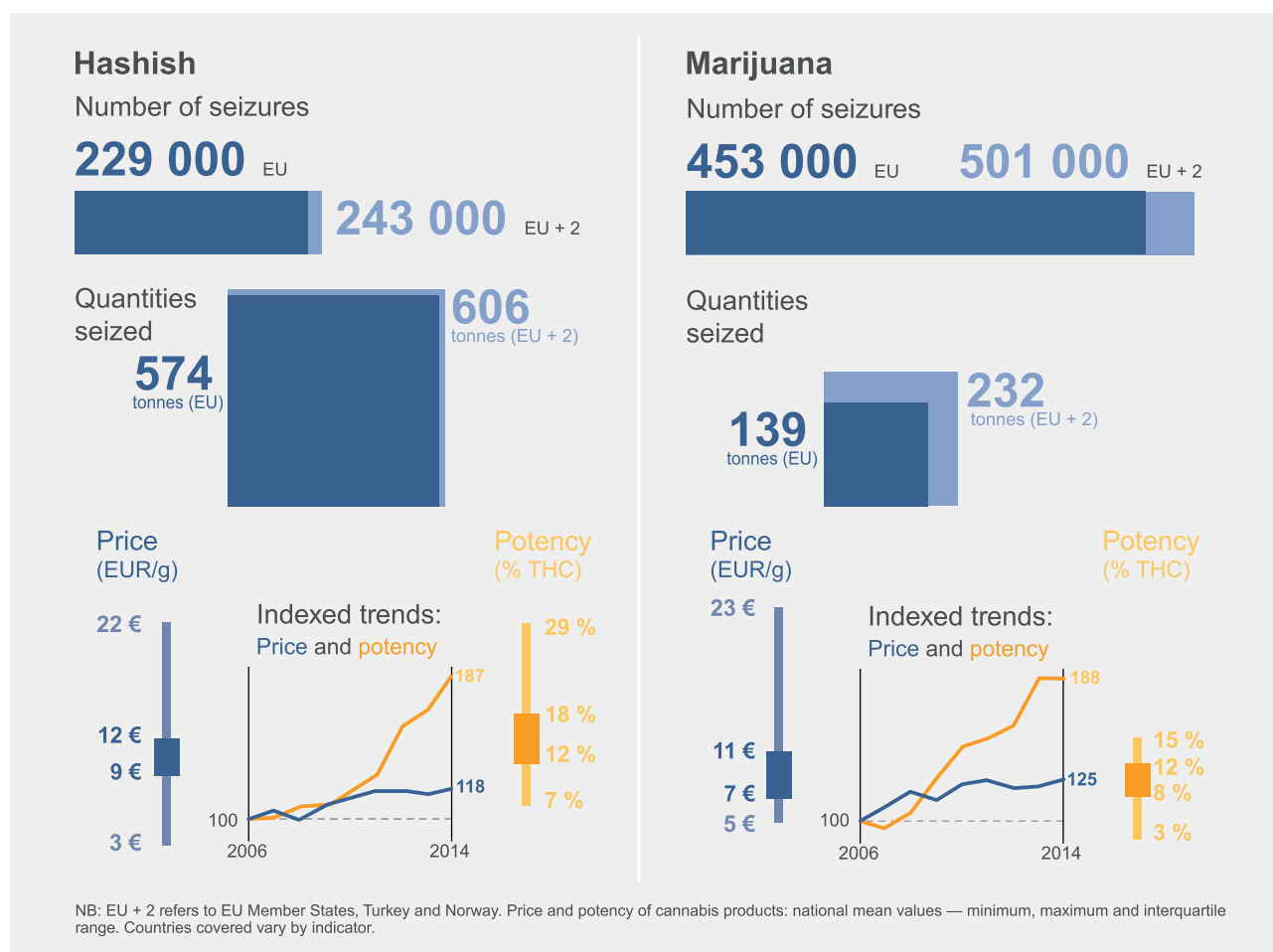
Indian hemp (*cannabis indica*) is morphologically similar to *cannabis sativa*. Taxonomically, both *cannabis indica* and *cannabis sativa* are the sub-species of the *Cannabis* genus. Female Indian hemp plants contain cannabinoids, including delta-9-tetrahydrocannabinol (Δ^9-THC), which is the main psychoactive constituent. Aside from Δ^9-THC, Indian hemp (further referred to as cannabis) also contains other cannabinoids, such as cannabinol (CBN), cannabidiol (CBD) and tetrahydrocannabinolic acid (THCA). THCA is not a psychoactive ingredient, but it converts into active Δ^9-THC. The conversion progresses slowly during storage and rapidly during heating (e.g. while smoking cannabis). Cannabis do not have any practical applications, however, they enjoy considerable popularity due to psychoactive properties of delta-9-tetrahydrocannabinol, which is present predominantly in the flowering tops (commonly known as marijuana[4]) and in the leaves.

1 P.F. Stevens, *Angiosperm Phylogeny*, www.mobot.org/MOBOT/research/APweb/
2 Mahmoud A. ElSohly, *Marijuana and the Cannabinoids*, Humana Press Inc., New Jersey 2007.
3 C. Ratsch, *Rośliny miłości* [*Plants of Love*], GAMMA Publishing House, Warszawa 1992.
4 T. Gorczyński, *Rośliny użytkowe* [*Crop Palnts*], Wiedza Powszechna, Warszawa 1966.

Hashish

Number of seizures

229 000 EU

243 000 EU + 2

Quantities
seized

606
tonnes (EU + 2)

574
tonnes (EU)

Price
(EUR/g)

Potency
(% THC)

22 €

29 %

Indexed trends:
Price and potency

187

18 %

12 €

9 €

12 %

118

7 %

100

3 €

2006   2014

Marijuana

Number of seizures

453 000 EU   **501 000** EU + 2

Quantities
seized

232
tonnes (EU + 2)

139
tonnes (EU)

Price
(EUR/g)

Potency
(% THC)

23 €

Indexed trends:
Price and potency

15 %

11 €

188

12 %

7 €

125

8 %

5 €

100

3 %

2006   2014

NB: EU + 2 refers to EU Member States, Turkey and Norway. Price and potency of cannabis products: national mean values — minimum, maximum and interquartile range. Countries covered vary by indicator.

Fig. 1. Number of seized illicit cannabis plantations (2014) in the EU countries as well as EU countries, Turkey and Norway (UE+2).

Overall situation in the European market regarding cannabis-based products

According to the data supplied by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA),[5] cannabis based products constitute the largest share of the European illicit drug market. In 2013, their estimated retail sales amounted to 9.3 billion euros. Cannabis are the most commonly seized drug – in 2014, they made up for more than three quarters (78%) of all drug seizures in Europe – which reflects their widespread use (Fig. 1). Over the years, the price of cannabis has been gradually increasing, albeit not dramatically, whereas the "potency" has increased significantly as a result of higher Δ^9-THC (active ingredient) content.

Considering the above, it is no surprise that illicit cannabis plantations are commonly encountered in both Europe and Poland. According to the data supplied by the EMCDDA, the number of cannabis plants seized in Europe from both indoor and outdoor plantations rose from 1.5 million in 2002 to 3.4 million in 2014. Indoor plantations often consist of specially selected, modified seeds, most frequently purchased through online shopping stores. The plants grown from such seeds exhibit a very high total content of Δ9-THC and THCA, amounting even to several dozen percent.

Legal aspects of cultivating cannabis

Due to psychoactive effect of Δ^9-THC, cannabis with a high content of this substance as well as THCA are subject to control in many countries, including Poland According to a recent study on cannabis plants originating from illicit plantations carried out by forensic laboratories, the total Δ^9-THC/ THCA content in mature plants is the highest in the flowering tops (even up to 20%), lower in the leaves (typically a few percent) and the lowest in the stems (tenths of a percent), whereby in some stems, the Δ^9-THC content may approach zero. An average total Δ^9-THC/ THCA content in plants originating from outdoor plantations amounted to 3.78%, whereas in the case of indoor plantations, it was almost three times higher, i.e. at approximately 8.90%. According to Article 4 of the

[5] *Recommended Methods for the Identification and Analysis of Cannabis and Cannabis Products*, United Nations, New York 2009.

Act on Counteracting Drug Addition (ACDA)[6], cannabis plant is defined as "any plant of the genus *Cannabis L.*". Furthermore, the ACDA offers a definition of fibrous hemp, which does not constitute a botanical variety. The definition enables legal assessment of cannabis towards the inclusion into the group of substances, which are prohibited by the ACDA. Fibrous hemp is defined as: "plants of the species *Cannabis sativa L.*, in which the sum of contents of delta 9-tetrahydrocannabinol and tetrahydrocannabinolic acid (delta-9-THC-2-carboxylic acid) in flowering or fruiting plant tops, from which the resin has not been removed, is below 0.20% by weight calculated on the dry matter". Further provisions of the ACDA stipulate that the cultivation of cannabis plants, save for fibrous hemp, is prohibited, regardless of the cultivated area (Article 63). Article 62 also penalizes the possession of cannabis, save for fibrous hemp, defined in Article 4 as "any overground part of the cannabis plant (whether single or in a mixture), save for the seeds, in which the sum of contents of delta 9-tetrahydrocannabinol and tetrahydrocannabinolic acid (delta-9-THC-2-carboxylic acid) exceeds 0.20%.".

Methods of detection of illicit plantations

Illicit cannabis plantation are most typically detected, based on information obtained from police informants or uninvolved bystanders (e.g. passers-by, neighbors). Additional indicators, available in the case of indoor plantations, include:

- analysis of electricity consumption – cannabis cultivation entails a high daily energy consumption. The energy is needed to ensure adequate lighting, continuous ventilation, correct air temperature inside the facilities, etc;
- analysis of water consumption – the plantation requires constant watering, which generates high water consumption;
- characteristics, intensive odor, especially during the flowering stage, which can be detected by bystanders (hence, the facilities are usually equipped with fans containing an absorbent (usually, activated carbon), which absorbs odors);
- the use of thermal imaging cameras, enabling the detection of an intensive thermal radiation, resulting from the presence of heat and regular lamps inside the facilities.

The preliminary studies conducted worldwide focused on the possibility of applying alternative tools for the detection of illicit plantations. A research paper by Walthall et al.[7] describes an attempt to use cannabis spectral signatures at different growth stages in order to determine the optimal timing of detection and liquidation of an illicit plantation. The authors point out that until recently, similarly as in Poland, the only tools available in the U.S. for the detection of illicit plantations have included the analysis of information obtained from human sources, historical data on previous plantations and predicting cannabis cultivation, based on the availability of power lines, water sources and communication routes (roads). Another method of identification involved aerial surveillance carried out by observers located on special aircraft platforms. In the light of the above, an attempt was made to develop a sensor system utilizing the spectral properties of cannabis that would support the work of DEA (Drug Enforcement Administration Agents) agents. This electro-optical system would also assist the police by indicating the optimal time to raid and liquidate a plantation. i.e. when the suspects are present in the facility and can be apprehended. It is generally known that the continuous presence of plantation caregivers is indispensable at certain growth stages. In order to elaborate the spectral signature of cannabis, the authors focused on the spectral properties of the leaves at various growth stages. Subsequently, the spectral signatures were compared against those of other plants in order to confirm their uniqueness and the possibility of unambiguous identification of cannabis in the mixtures with other plant species. The experiment involved both indoor and outdoor plantations containing cannabis plants with various Δ^9-THC content (specially selected seeds). The authors focused on a characteristic, unique blue-green and emerald green spectrum of cannabis, which could be utilized in the detection of illicit plantations. Importantly, it was shown that the Δ^9-THC content in the leaves does not affect the identification capability of this method. Spectral techniques, in particular, hyperspectral imaging technology (camera) offering a high-resolution spectral sampling have also been used in the study conducted by Israeli researchers[8]. The collected spectra enabled the identification of cannabis from amongst many other plant species. The tests were carried out by placing a hyperspectral camera within a short distance from the plants as well as distantly in the air (simulation of aerial surveillance). It was determined that the best results were obtained for the wavelength ranges of 530-550 nm, 670-680nm and 705-720 nm. Within these ranges, it was possible to identify cannabis plants and distinguish them from any other Mediterranean plant species included in the experiment.

Illicit cannabis plantations in Poland

In Poland, between January 2012 and April 2016, the police detected and liquidated a total of 5385 illicit

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6 *European Drug Report*, EMCDDA 2016.
7 *Act on Counteracting Drug Addiction of 25 July 2005* (consolidated text 2016, item 224, with further amendments).

8 Ch.L. Walthall, C.S.T. Daughtry, L. Pachepsky, *Development of Cannabis Spectral Signatures and Cannabis Growth Simulation Model*, Progress Raport FY 2003.
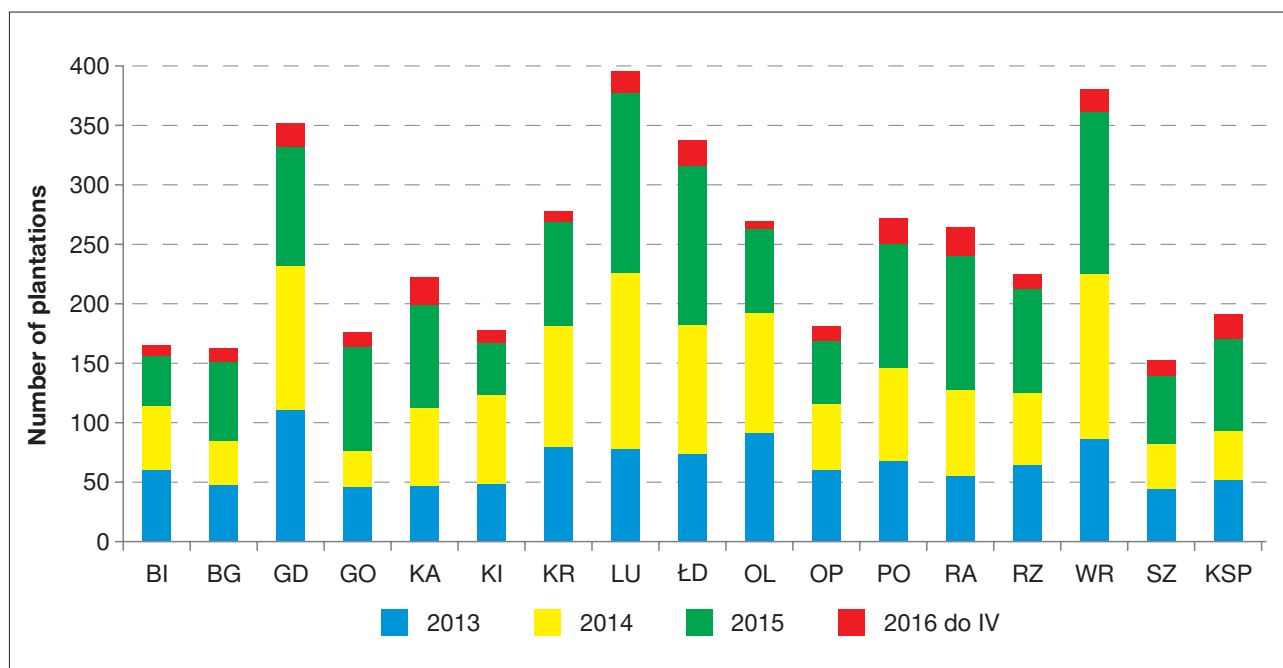
Fig. 2. Number of cannabis plantations detected by the police in the years 2013-2016, voivodeship by voivodeship.

plantations of cannabis other than fibrous hemp, in which 275477 plants were grown[9]. Charts 1-3 summarize the plantations detected and liquidated in particular years, broken down into individual police garrisons (voivodeships). The summary does not include the year 2012, during which the data were not collected separately for each garrison, but only collectively. The total number of illicit plantations liquidated in 2012 amounted to 1205 and it entailed damaging 58156 plants. In the following years, the corresponding numbers were as follows: 2013 – 1120 plantations and 46989 plants; 2014 – 1319 plantations and 67949 plants; 2015 – 1494 plantations and 89834 plants. By April 2016, 247 plantations and 12549 plants were liquidated.

The data analysis revealed that the numbers of illicit plantations and plants have been on the rise since 2012, which could be attributed to the growing popularity of cannabis-based products on the illegal drug market. The scale of cultivations varied from single plants grown "for own needs" in pots located inside or outside housing and farm facilities, to professional, fully automated cultivations maintained by criminal groups. Poland's leader in the number of detected and liquidated plantations is the Lublin police garrison – 394 plantations, followed by the Wrocław garrison – 379 plantations and the Pomerania garrison – 348 plantations. The smallest number of plantations have been liquidated by the West Pomerania garrison – 152. However, the above figures do adequately represent the total number of plants detected. When the

number of plants is considered, Łódź Voivodeship takes the first place with 58327 plants. About half this amount was seized in Lower Silesian Voivodeship – 24223 and in Greater Poland Voivodeship – 22897. The smallest number of plants have been detected in Subcarpathian Voivodeship – 4592.

Plantation yield estimation

An amendment to the ACDA that entered into force on 1 July 2015, concerned the definition of cannabis. Also, the means of securing the plants seized from the plantations and estimating the plantation yield have changed. In the case of a plot containing the plants at the same growth stage, 5 whole plants (without roots) are taken at random from different points, pooled together and submitted for laboratory testing as one sample. If the plot covers a vast area and contains a significant number of plants (several hundred or more), it is appropriate to divide it into sectors and sample 5 plants from each sector. The samples from each sector are pooled together and treated as one sample. For example, if a plot containing 1000 plants gets divided into two sectors, 2 separate samples, each consisting of 5 whole plants without roots should be submitted for laboratory analysis. Pursuant to the ACDA currently in force[7], after cutting, the entire cannabis plant is considered herbal cannabis. Therefore, while estimating the plantation yield (in terms of herbal cannabis), it is necessary to account for the weight of stems, which also applies to flowering or fruiting plants. A different yield estimation model applies with respect to commercial portions. Due to the fact that the most frequently sold cannabis parts are inflorescences

9 I. Azaria, N. Goldshleger, E. Ben-Dor, R. Bar-Hamburger, *Detection of Cannabis Plants by Hyper-Spectral Remote Sensing Means*, www.spectralcameras.com/files/AISA/AISA_cannabis.pdf
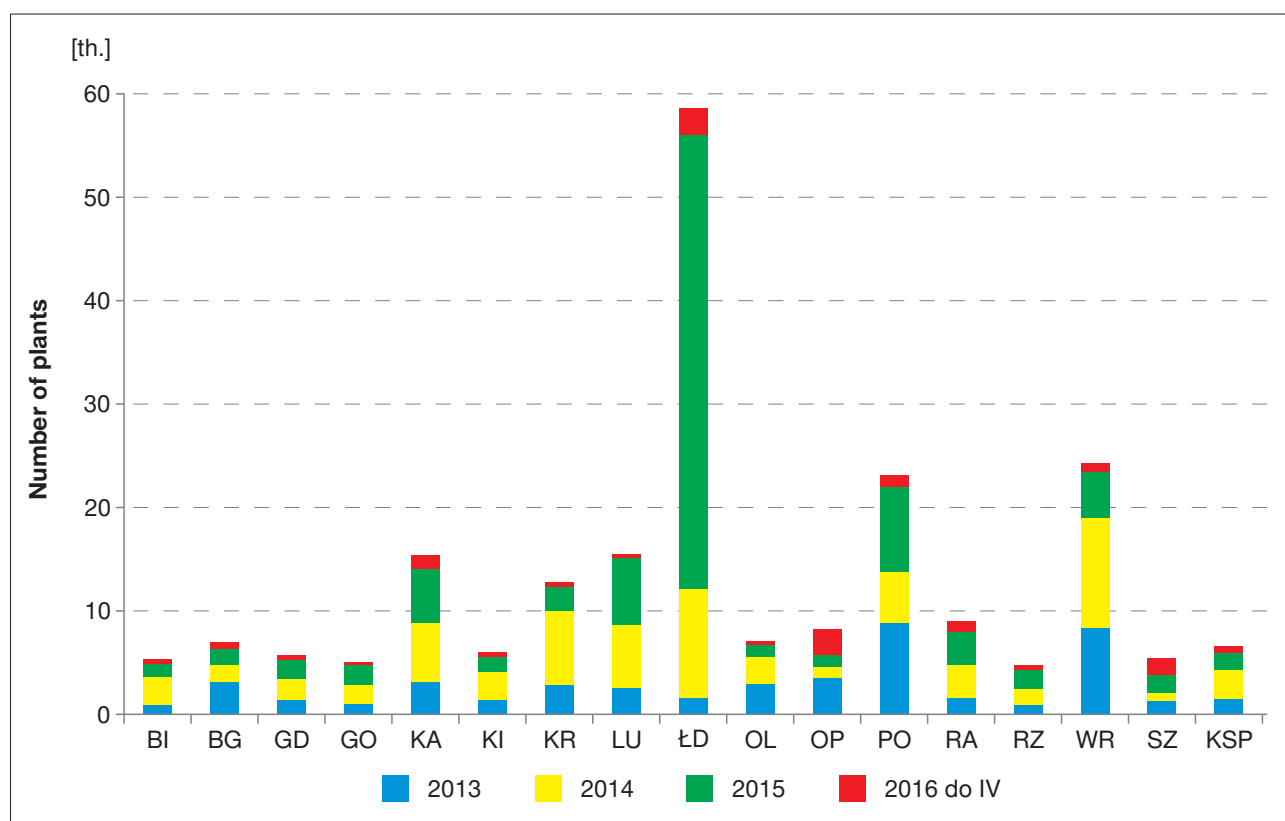
Fig. 3. Number of cannabis plants seized from illicit plantations detected by the police in the years 2013-2016.
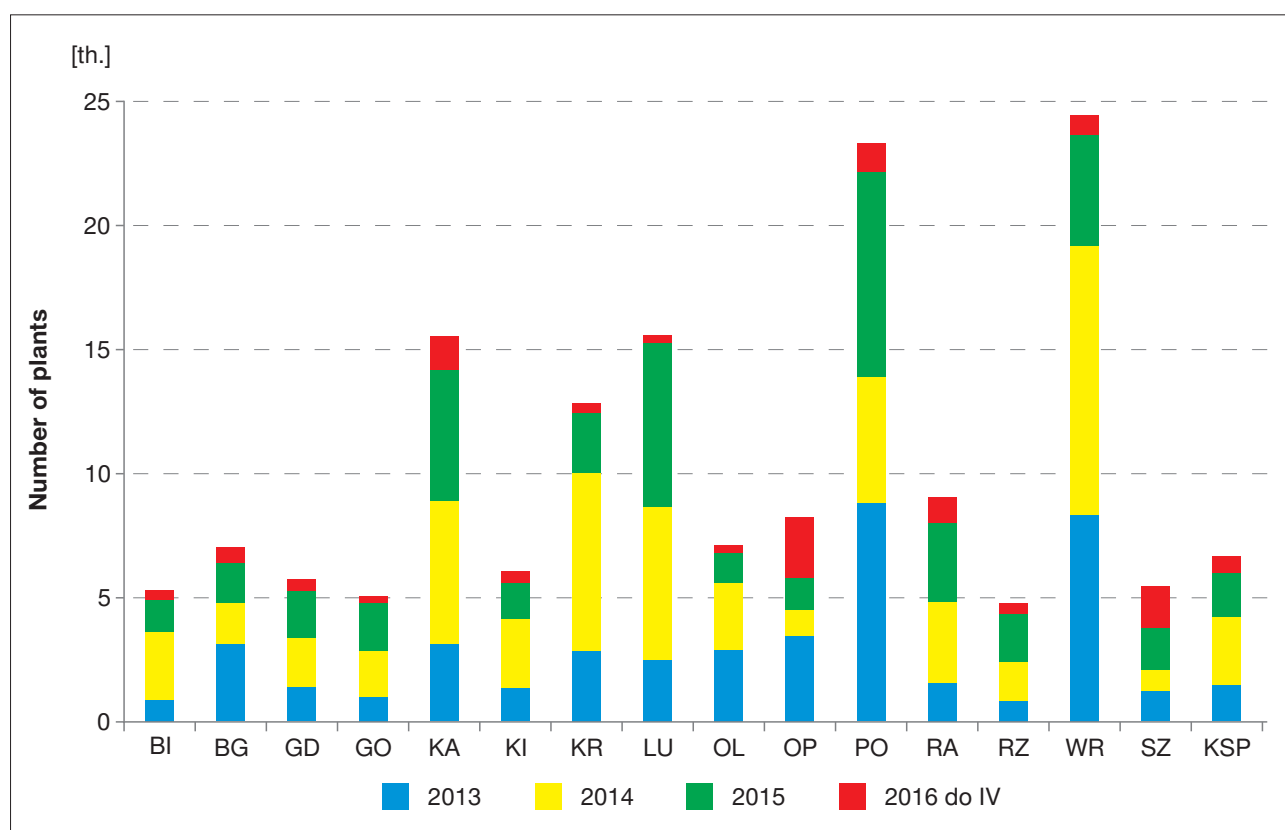
Fig. 4. Number of cannabis plants seized from illicit plantations (excluding Łódź Voivodeship) detected by the police in the years 2013-2016.

Table 1. Sizes of commercial portions and prices of selected drugs available on Polish illegal market.

Region	Unit	Drug name						
		Marihuana	Amphetamine	Hashish	Heroin	Cocaine	MDMA	Mephedrone
Białystok	Quantity (g)	1	1	1	0.1	1	*	1
	Price (zł)	30	40	30	50	250	10	30
Warszawa	Quantity (g)	1	1	1	1	1	*	1
	Price (zł)	45	45	55	275	275	15	65
Gdańsk	Quantity (g)	1	1	1	1	1	*	1
	Price (zł)	35	30	30	225	225	12	30
Katowice	Quantity (g)	1	1	1	NDA	1	*	NDA
	Price (zł)	25	30	40	NDA	200	8	NDA
Kielce	Quantity (g)	1	1	1	NDA	1	*	1
	Price (zł)	45	35	35	NDA	300	15	80
Kraków	Quaantity (g)	0.9	0.9	NDA	NDA	NDA	NDA	NDA
	Price (zł)	25	35	NDA	NDA	NDA	NDA	NDA
Lublin	Quantity (g)	1	1	1	NDA	1	1	1
	Price (zł)	40	40	40	NDA	150	40	40
Łódź	Quantity (g)	1	1	1	0.1	1	*	NDA
	Price (zł)	40	35	45	60	250	15	NDA
Opole	Quantity (g)	1	1	1	1	1	1	NDA
	Price (zł)	25	30	30	180	250	30	NDA
Rzeszów	Quantity (g)	1	1	1	NDA	1	*	NDA
	Price (zł)	30	35	45	NDA	250	15	NDA
Radom	Quantity (g)	1	1	1	1	1	*	1
	Price (zł)	35	40	40	160	200	15	50

Legend:
„*" 1 tablet
„NDA" No Data Available

(the so-called marijuana), less frequently the leaves and only occasionally the stems, the weights of herbal cannabis and marijuana will not be equal. Therefore, in the case of flowering plants, the yield of marijuana (expressed as weight) is determined for inflorescences detached from dry plants delivered to the laboratory. The result obtained is divided by the number of plants in the sample and subsequently multiplied by the number of plants secured from the plantation. If the plants secured are outside the flowering stage, the weight of marijuana is approximated by assuming an average yield of 22g per plant, in accordance with the recommendations of EUROPOL[5].

Commercial portions and prices of marihuana in relation to other drugs

Both drug prices and sizes of commercial portions available on the illegal market vary depending on the region, which mainly reflects the demand and availability of these products. Clearly, the less accessible a given drug is, the greater interest it enjoys and with a higher price tag it comes. Table 1 summarizes the data concerning commercial portions and prices of the selected drugs in the year 2016, provided by the police.

The available data indicate that marijuana prices are slightly different in particular voivodeships, however, not to a significant extent. The price is slightly lower

compared with amphetamine or hashish and substantially lower than the price of cocaine or heroin. Based on the data collected, it is also apparent that nowadays the basic commercial portion of marijuana, amphetamine, hashish and cocaine is 1 gram, whereas in the case of MDMA it is one tablet. It should be born in mind that a commercial portion is not equal to the quantity consumed or to the active dose. It exclusively refers to the quantity of a given drug available on retail illegal markets and not to the number of persons who can become intoxicated with this quantity. The size of a commercial portion depends heavily, among other factors, on the content of the active ingredient. The data obtained based on the analyses of herbal cannabis conducted in the years 2015-2016 by forensic laboratories of the police revealed variability in the total contents of Δ^9-THC and THCA. In 2015, the content ranged from 0.09% to 35%, whereas in 2016, it varied between 0.01% to as much as 48%.

Conclusions

The growing consumption of cannabis-based products and the ensuing activity of individuals engaging in illicit cultivations remain an important issue. Moreover, the increasing number of plantations maintained by organized criminal groups as well as an increase in active ingredient content (Δ^9-THC) in herbal cannabis, pose a major challenge for law enforcement authorities in terms of protecting citizens' life and wellbeing. Finally, legislative changes implemented in Poland as a response to the noticeable drug abuse problem constitute yet another challenge for experts issuing opinions for the purposes of drug-related cases, including the cases concerning illicit cannabis cultivations.

Sources of figures:

Figure 1: European Drug Report, EMCDDA 2016.
Figure 2-4: National Police Headquarters.

Source of table: authors.

Translation Rafał Wierzchosławski